



Sustainable constructions: challenges and technologies in Brazilian civil engineering

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SUMMARY

Sustainability has become one of the central pillars of contemporary civil engineering, responding to environmental, economic and social emergencies. This scientific article aims to discuss the main challenges and present the emerging technologies that drive sustainable construction in Brazil. Through a bibliographic review and qualitative analysis, the aim is to understand how civil engineering can be an agent of change in promoting sustainable development. An overview of the most widely adopted sustainable practices is also presented, such as the use of recycled materials, energy efficiency techniques and environmental certifications.

Keywords: Civil Engineering; Sustainability; Innovation; Sustainable Construction; Environment.

1 INTRODUCTION

Concern for the environment and the scarcity of natural resources have driven the search for sustainable solutions in several areas, especially in the construction industry, which is one of the human activities that has the greatest impact on the environment. In Brazil, this challenge is intensified in the face of an expanding urban landscape, with increasing demands for infrastructure and housing.

According to John Elkington (1998), the concept of sustainability must be understood based on the "Triple Bottom Line", which encompasses three pillars: social, environmental and economic. From this perspective, sustainable constructions are those that aim to minimize environmental impacts, promote well-being for communities and ensure economic viability. In this context, civil engineering becomes a protagonist in the application of technologies and techniques that integrate these principles.

2 METHODOLOGY

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This article was prepared based on a qualitative bibliographic review, using national and international academic sources, including books, scientific articles, reports

technical and relevant legislation. Documents from the last two decades that address the relationships between civil construction, sustainability and technological innovation were analyzed, with a focus on the Brazilian context.

3 CIVIL CONSTRUCTION AND ITS ENVIRONMENTAL IMPACTS

According to the World Green Building Council (2019), the construction industry is responsible for around 39% of global greenhouse gas emissions. In Brazil, according to the Brazilian Council for Sustainable Construction (CBCS, 2020), this activity consumes around 75% of extracted natural resources and produces approximately 60% of urban solid waste.

This reality demands the restructuring of the sector, with the incorporation of sustainable practices and innovations that aim to reduce environmental impacts throughout the entire life cycle of buildings, from design to demolition.

4 CHALLENGES FOR SUSTAINABILITY IN BRAZILIAN CIVIL ENGINEERING

Despite the growing discussion on sustainability, several challenges are still faced for its effective implementation in the construction sector. Among them, the following stand out:

- **High initial cost:** Many sustainable technologies require larger initial investments, which inhibits adoption in small and medium-sized enterprises (MOURA; OLIVEIRA, 2021).
- **Lack of professional training:** There is a lack of qualified labor to apply sustainable techniques.
- **Traditional construction culture:** Resistance to change and the adoption of methods innovators is still common in many Brazilian regions.
- **Lack of government incentives:** The absence of effective public policies and tax incentive mechanisms limits the advancement of sustainability in construction.

5 INNOVATIVE TECHNOLOGIES AND SOLUTIONS

Despite the difficulties, several solutions have been successfully implemented in sustainable constructions in Brazil:

- **BIM (Building Information Modeling):** Technology that allows optimized planning and management, reducing waste (SOUZA; PEREIRA, 2022).
- **Green roofs and ventilated facades:** Reduce internal temperatures and contribute to the energy efficiency of buildings.
- **Rainwater reuse and grey water reuse systems.**

- **Recycled materials:** Such as rubble blocks, recycled concrete and use of reforested wood.
- **Environmental certifications:** Such as the LEED (Leadership in Energy and Environmental Design) seal, which encourages good practices in construction.

6 FINAL CONSIDERATIONS

The Brazilian construction industry is experiencing a crucial moment of transformation. Adopting sustainable practices is no longer an option but a necessity in the face of the global environmental crisis. For sustainability to become a reality in the sector, the commitment of all stakeholders is essential: engineers, architects, construction companies, government and society.

Civil engineering, with its vast field of activity, can lead this change through innovation, ongoing training of professionals, and the conscious use of natural resources. Sustainability, in addition to being a responsibility, is an opportunity to generate value, reduce operating costs, and improve the quality of life of the population.

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